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[Claim(s)]
[Claim 1] The bronze alloy characterized by obtaining the machinability which miniaturized the crystal into bronze alloy material, and where the mechanical property was improved and stabilized by adding P0.005-0.1% and B0.005-0.2% in the bulk density into it.
[Claim 2] The addition ingredient of P and B in Claim 1 is a bronze alloy which is a bulk density and are P0.01-0.03% and B0.01-0.03%.
[Claim 3] The bronze alloy characterized by the remainder consisting of Cu B 0.005 to 0.2% P 0.005 to 0.1% in 4 to 6% of Sn, 4 to 6% of Zn, 1.5 to 2.5% of Bi, and 0.8 to 1.2% of Se by a bulk density.
[Claim 4] The addition ingredient of P and B in Claim 3 is a bronze alloy which is a bulk density and are P0.01-0.03% and B0.01-0.03%.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It is related with the bronze alloy which this invention relates to a bronze alloy, and especially this invention excels [bronze alloy] in mechanical strength, elongation, and machinability, for example, fits piping instruments for waterworks, such as a bulb.
[0002]
[Description of the Prior Art] Generally, a bronze cast (CAC406) is excellent in fluidity, corrosion resistance, machinability, and resistance to pressure, and moreover, since the fluidity at the time of melting is good, it fits casting of a certain amount of complicated form. Therefore, generally many this bronze cast to piping instruments for waterworks, such as a bulb, a cock, and a joint, etc. is used.
[0003] However, it is a big social problem noting that the lead contained in bronze has a bad influence on a human body these days, and also globally, the amount of extraction to the inside of leaden tap water is being regulated severely. Then, based on such a situation, development of a useful lead loess copper alloy newly serves as pressing need, and various kinds of material, such as Bi system, a Bi-Se system, and a Bi-Sb system, is developed in it.
[0004]
[Problem to be solved by the invention] However, if comparison examination of the lead loess copper alloy material developed until now is carried out, the actual condition will have come to obtain a usual mechanical property and usual machinability equivalent to a bronze alloy (CAC406).
[0005] Its attention was paid to the miniaturized technology of a crystal when this invention person etc. inquired wholeheartedly, in order to solve these problems. It is known that a crystal miniaturizes if the element which generally extends the solidification temperature range of a base material is added in a minute amount about the miniaturized technology of this crystal. In this case, generally to the copper alloy, addition of elements, such as Zr, B, and Ti, is validated, and utilization is also widely made in Cu and a brass system alloy. on the other hand -- in the alloy of a bronze system -- the above -- even if it adds which crystal miniaturization agent, the actual condition has come to attain a satisfactory crystal miniaturization.
[0006] Then, in order that this invention may solve the conventional technical-problem point, it results in development in view of the miniaturized technology of the conventional crystal mentioned above, and aims at raising mechanical strength, elongation, and machinability the bronze system material and by miniaturizing a crystal in the bronze material of lead loess especially.
[0007]
[Means for solving problem] In order to attain the above-mentioned purpose, invention concerning Claim 1 is the bronze alloy which obtained the machinability which miniaturized the crystal into bronze alloy material, and where was a bulk density, and the mechanical property was improved and stabilized by adding P0.005-0.1% and B0.005-0.2% into it. In this case, P0.01-0.03% and B0.01-0.03% of the range is desirable at a bulk density.

[0008] Invention concerning Claim 3 is a bulk density, and is a bronze alloy with which the remainder consists of Cu B 0.005 to 0.2% P 0.005 to 0.1% in 4 to 6% of Sn, 4 to 6% of Zn, 1.5 to 2.5% of Bi, and 0.8 to 1.2% of Se. In this case, P0.01-0.03% and B0.01-0.03% of the range is desirable at a bulk density.

[0009]

[Mode for carrying out the invention] In invention concerning Claim 1 and 2, the addition meaning added in very small quantities into bronze alloy material and the Reason for limitation of B and P are explained.

Addition meaning of B (boron): B is effective in order to increase the number of crystal generation sites generated from a mold at the time of after-casting solidification. That is, as shown in drawing 1 , when the Cu alloy containing B is cast in a mold 1, the crystal miniaturization of the grade which is independent addition of B occurs, and as shown in drawing 1 , the phenomenon which becomes very small in the width of the crystal 2a which is a columnar crystal generated in ****** 1a of a mold 1 occurs simultaneously. This shows that it is effective in B increasing the number of nucleation sites on ****** 1a to a Cu alloy. In addition, three in a figure is a molten metal.

[0010] The Reason for limitation of B: At less than 0.005%, the increase effect of the number of crystal generation sites has low B, at 0.2% or more, it is [at the time of solidification] over, and deterioration of a mechanical property is accepted by the increase in a tendency. Then, the addition range was made into 0.005 to 0.2%. In it, 0.01 to 0.03% of addition range is desirable at a bulk density.

[0011] Next, the addition meaning and the Reason for limitation of P are explained.

P (phosphorus): As shown in drawing 2 , P has the work which promotes generation isolation of the crystal 2b of the equiaxed crystal on ****** 1a.

Moreover, the isolation facilitatory effect of a crystal is low, and at 0.1% or more, while fluidity falls, big and rough-ization by remelting of a crystal is caused less than [P0.005%]. Then, the addition range was made into 0.005 to 0.1% of range by the bulk density. In it, 0.01 to 0.03% of addition range is desirable.

[0012] And by combining these two elements, B and P, suitably by addition ingredient within the limits, as shown in drawing 3 , it became possible to realize the miniaturization of the remarkable crystals 2a and 2b.

[0013] In invention concerning Claim 3 and 4, since it is the same as that of invention in Claim 1, the addition meaning added in very small quantities into bronze alloy material and the Reason for limitation of B and P are omitted. Especially the bronze alloy material said here is a bulk density, and, in 4 to 6% of Sn, 4 to 6% of Zn, 1.5 to 2.5% of Bi, and 0.8 to 1.2% of Se, the remainder consists of Cu B 0.005 to 0.2% P 0.005 to 0.1%. Zn becomes suitable for the metal fittings excellent in fluidity for piping instruments by considering it as 4 to 6% by above Sn considering it as 4 to 6 weight % for improvement in an increase and abrasion resistance of intensity and hardness, and corrosion resistance.

[0014] Above Bi is added 1.5 to 2.5weight %, and without almost dissolving to Cu, Sn, and Zn which are the bronze main ingredients, this Bi is harmless as drinking water, and can raise machinability and printing-proof nature. Moreover, Se is added 0.8 to 1.2weight %, and this Se forms Zn, Cu, and an intermetallic compound in an alloy, and raises machinability. In addition, although contained 1.2 or less weight %, when Pb uses recycling material abundantly and manufactures a copper alloy in this case, it is a range contained actually. Even if Pb is eluted underwater, this range is a range which can stop that amount of elution of Pb very low, and can raise machinability, printing-proof nature, and resistance to pressure rather than the conventional bronze alloy in this case.

[0015] Moreover, since B is added into bronze alloy material, Zn contained in this alloy and Se are the elements which are easy to carry out oxidation loss in a hardener, but the invention concerning Claim 3 and 4 can control wear of Zn and Se by the molten metal reducing action of B. Therefore, by being able to suppress a development of the dissolution dirt which contains Se so much, and suppressing wear of Se and Zn, the yield of the dissolution can improve and a cost cut can be aimed at.

[0016]

[Working example] The desirable work example included the example of an examination of the bronze alloy which contained Bi and Se among the bronze alloys in this invention is explained. The photograph (x0.8 time) of drawing 5 - drawing 8 shows the metal macrostructure audit observation when casting the bronze alloy which added B and P by combination as shown in Table 1 in the casting temperature of 1100 degrees C to organic Co2 mold 1 which consists of No. 7 silica sand as shown in the example of an experiment of the drawing 4 (**) and (**).

[0017]

[Table 1]

成 分 値 表（重量%）

	No.	B,P 添加量	Cu	Zn	Pb	Se	Bi	Sn	B	P
比	1	無添加	87.4	4.46	0.12	0.92	1.84	5.24	—	—
較	2	B0.03	87.2	4.52	0.09	0.94	1.90	5.21	0.032	—
例	3	P0.03	87.2	4.49	0.10	0.94	1.91	5.17	—	0.029
	4	B0.005,P0.005	86.9	4.61	0.06	0.93	1.88	5.40	0.005	0.004
実	5	B0.01, P0.01	86.8	4.62	0.12	0.95	1.94	5.33	0.011	0.010
施	6	B0.03, P0.03	87.2	4.49	0.09	0.93	1.89	5.10	0.028	0.031
例	7	B0.05, P0.05	86.9	4.55	0.09	0.98	1.90	5.29	0.047	0.049
	8	B0.1, P0.1	86.7	4.49	0.10	0.97	1.92	5.40	0.098	0.101

[0018] When B and P add only B0.03% as compared with an additive-free case (comparative example 1) so that clearly from the result of the photograph of drawing 5 - drawing 8 (comparative example 2), it turns out that the number of crystal generation sites is increasing in the mold surface. On the other hand, when only P0.03% is added (comparative example 3), it is changeless to the number of generation sites of the crystal in the mold surface, but it turns out that crystal isolation is promoted and the crystal is miniaturized. When B0.03% and P0.03% are added targeting the synergistic effect of the two above-mentioned elements (B, P) based on these results (work example 6 shown in Table 1) The crystal near the mold surface at the time of adding only B0.03%, as shown in the photograph of drawing 7 (comparative example 2), Or compared with the size of the crystal isolated from the mold surface at the time of adding only P0.03% (comparative example 3), and each crystal, it was very fine, and the more remarkable detailed organization was able to be obtained. Therefore, as compared with the usual bronze alloy, the bronze alloy excellent in mechanical strength, elongation, and machinability can be obtained.

[0019] Subsequently, the result of having investigated B added in the work example 4-8 in Table 1, the mechanical strength by the difference in the amount of P, elongation, and machinability is shown in Table 2. In addition, mechanical strength here and elongation are the tensile strength and elongation by a tensile test. The tensile test machined the test specimen into JIS-B and a No. 2001.4 test piece, and examined this. Moreover, machinability carries out **** processing according to cutting conditions as show a test specimen in Table 3, and compares the cutting force concerning the byte for every material at this time as the machinability index when setting cutting force of C3604 to 100.

[0020]

[Table 2]

B，P添加による諸性質の変化

No.	添加元素 (%)	引張強さ (N／mm²)	伸び (%)	※切削性指数
1	無添加	215	18	85
4	B0.005,P0.005	225	19	85
5	B0.01, P0.01	237	21	86
6	B0.03, P0.03	230	20	86
7	B0.05, P0.05	224	20	87
8	B0.1, P0.1	216	18	88

※C3604の切削性を100としたときの指数

[0021]

[Table 3]

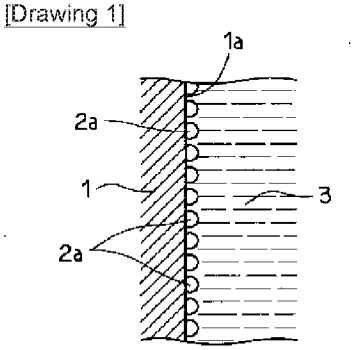
[0022] As shown in Table 2, tensile strength and elongation became the maximum at the time of B0.01 and P0.01% addition, and its tensile strength improved 17% by elongation 10% as compared with the additive-free comparative example 1. On the other hand, it was checked that machinability improves with the increase in the amount of addition of B and P.

[0023] [the material] although the above-mentioned bronze alloy material is applied to piping instruments, such as valve member articles, such as a bulb for drinking water, a stem, a valve seat, and JISUKU, a cock, and a joint, and the apparatus for water-works pipes In addition, parts, such as warm water associated equipment, such as instruments, such as a strainer which ****, a pump, and a motor, or cock metal fittings which ****, and also a water heater machine, and the Minakami line, a member, etc. are further used for intermediate items in addition to the above-mentioned final product, an assembly, etc., such as a coil and a hollow stick, widely.

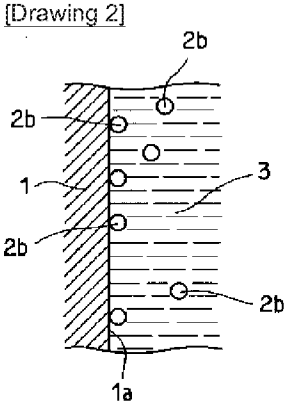
[0024]
[Effect of the Invention] The bronze alloy by the crystal miniaturization agent which was not obtained by the former according to this invention so that clearly from the above thing, In particular, the crystal miniaturization of a lead loess bronze alloy can be attained, and it is equal to the bronze alloy (CAC406) generally used from the former, and has the outstanding effect that the mechanical strength, the elongation, and the machinability beyond it are obtained.
[0025] Moreover, since the bronze alloy material in this invention has added B, it can suppress a development of the dissolution dirt containing Se. Moreover, since wear of Se and Zn can be suppressed as much as possible, the yield of the dissolution improves remarkably, and reduction of cost can be performed, and it excels also in economical efficiency.

[Brief Description of the Drawings]
[Drawing 1] It is the partial explanatory view having shown the crystal miniaturization phenomenon at the time of casting the bronze alloy containing B in a mold.
[Drawing 2] It is the partial explanatory view having shown the crystal miniaturization phenomenon at the time of casting the bronze alloy containing P in a mold.
[Drawing 3] It is the partial explanatory view having shown the crystal miniaturization phenomenon at the time of casting the bronze alloy of B and P entering both in a mold.
[Drawing 4] (b) (b) is a mold for experimenting in the bronze alloy in this invention.
[Drawing 5] It is the photograph (x0.8) in which the metal macrostructure when casting in the state where the both sides of B and P are not added was shown.
[Drawing 6] It is the photograph (x0.8) in which the metal macrostructure when casting in the state where add B and P is not added was shown.
[Drawing 7] It is the photograph (x0.8) in which the metal macrostructure when casting in the state where add P and B is not added was shown.
[Drawing 8] It is the photograph (x0.8) in which the metal macrostructure when casting where the both sides of B and P are added was shown.
[Explanations of letters or numerals]
1 Mold
2a, 2b Crystal
3 Molten Metal

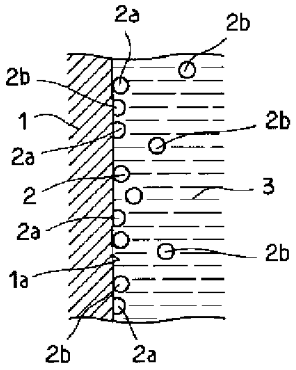
[Drawing 1]



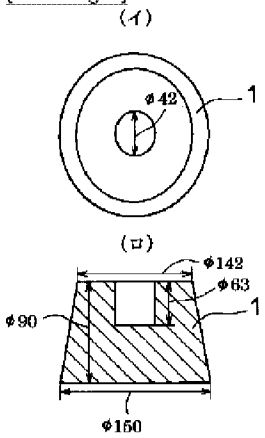
[Drawing 2]



[Drawing 3]

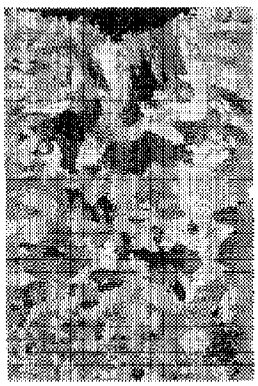


[Drawing 4]



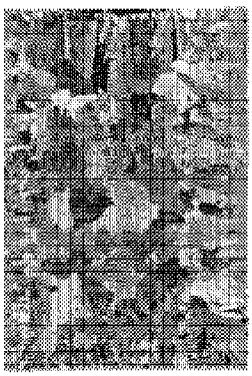
[Drawing 5]

(B, Pなし)



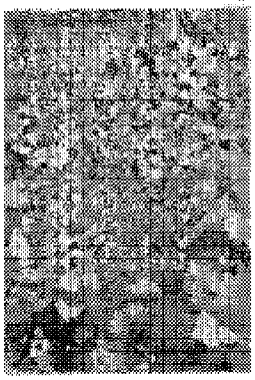
[Drawing 6]

(Bのみ)



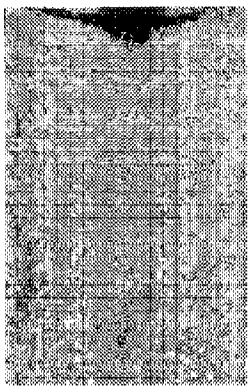
[Drawing 7]

(Pの2)



[Drawing 8]

(B, P両方添加)



[Translation done.]